APPENDIX D, SUMMARY TABLES OF SAFETY ANALYSIS RESULTS

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APPENDIX D

Summary Tables of Safety Analysis Results

This appendix presents tables summarizing results from the most recent Cassini mission safety analyses for the GPHS-RTG Final Safety Analysis Report (FSAR) (LMM&S 1997a-h) and the LWRHU FSAR (EG&G 1997) for use in the Final SEIS. The primary reference for the GPHS-RTG results was the FSAR Supplemental Analysis volume (LMM&S 1997h). The results presented by mission segment (Pre-Launch, Early Launch, Late Launch, VVEJGA, and Overall) include accident source terms, release probabilities, radiological consequences, mission risks, and average individual risks. These results are presented in the following tables:

Table D-1 Summary of Accident Source Terms

Table D-2 Summary of Mean Radiological Consequences

Table D-3 Summary of 5-th Percentile Radiological Consequences

Table D-4 Summary of 50-th Percentile Radiological Consequences

Table D-5 Summary of 95-th Percentile Radiological Consequences

Table D-6 Summary of 99-th Percentile Radiological Consequences

Table D-7 Summary of Mission Risks

Table D-8 Summary of Average Individual Risks

Table D-9 Summary of GPHS-RTG Uncertainty Analysis Results

Table D-10 summarizes the information sources for the results presented in Tables D-1 through D-9, along with notes related to values extracted from the information sources and any calculations performed in summarizing the results. In summarizing the results from the safety analyses in Tables D-1 through D-9, slight differences occur when compared to the source documents due primarily to roundoff.

For a given mission segment result type reported in Tables D-1 through D-9, results for the GPHS-RTG and LWRHU are first reported separately and then combined. The combined result represents a probability weighting of the separate results for the GPHS-RTG and the LWRHU. As an example of this procedure, consider the results for the mean health effects (without de minimis) for a VVEJGA inadvertent reentry, presented in Table D-2 as 13 health effects for the LWRHU at a total probability of release of 8.0×10^{-7} and 140 health effects for the GPHS-RTG

at a total probability of 6.3×10^{-7}. The combined result is calculated as follows:

$$\text{Combined (rounded): } 120 = [\ 13(8.0 \times 10^{-7}) + 140(6.3 \times 10^{-7})\ ] / 8.0 \times 10^{-7}$$

The results of 140 health effects for the GPHS-RTG and 13 health effects for the LWRHU cannot be simply added. The difference in the total probabilities of 8.0×10^{-7} for the LWRHU and 6.3×10^{-7} GPH-RTG reflects the situation that given a VVEJGA inadvertent reentry with a probability of 8.0×10^{-7}, there is a conditional probability of 1.0 that there would be a radiological consequence from the LWRHU and a conditional probability of $(6.3 \times 10^{-7} / 8.0 \times 10^{-7}) = 0.79$ that there would be a consequence from the GPHS-RTG. This difference in conditional probabilities is associated with the larger number of LWRHUs (157 considered in the analysis) compared to the number of GPHS modules (54) that reenter.

This probability weighting procedure has been followed in Tables D-1 through D-6, always normalizing to the higher of the two (GPHS-RTG or LWRHU) total release probabilities in each case. One exception to this approach to combining results occurs when the risk values in Tables D-7 and D-8 are combined. In this case, the risk is additive. Thus, the GPHS-RTG risk is added to the LWRHU risk to determine the combined risk, because the probabilities are already imbedded in the risk values.

Table D-1 Summary of Accident Source Terms (Page 1 of 2)

Mission Segment	Mission Phase	Source Term Contribution	Initiating Accident Probability[a]	Conditional Probability[b]	Total Probability[c]	Mean Source Term, Ci
Pre-Launch	0	GPHS-RTG	6.7×10^{-5}	7.8×10^{-1}	5.2×10^{-5}	4.68×10^{1}
		LWRHU[(d)]	6.7×10^{-5}	1.6×10^{-1}	1.1×10^{-5}	9.6×10^{-1}
		Combined	6.7×10^{-5}	7.6×10^{-1}	5.1×10^{-5}	4.7×10^{1}
Early Launch	1	GPHS-RTG	6.2×10^{-3}	1.1×10^{-1}	6.7×10^{-4}	1.76×10^{2}
		LWRHU[(d)]	6.2×10^{-3}	2.9×10^{-2}	1.8×10^{-4}	2.12×10^{-1}
		Combined	6.2×10^{-3}	1.1×10^{-1}	6.7×10^{-4}	1.76×10^{2}
Late Launch	3-8	GPHS-RTG	2.1×10^{-2}	1.0×10^{-1}	2.1×10^{-3}	2.61×10^{0}
		LWRHU[(d)]	2.1×10^{-2}	1.9×10^{-7}	3.9×10^{-9}	1.54×10^{-4}
		Combined	2.1×10^{-2}	1.0×10^{-1}	2.1×10^{-3}	2.61×10^{0}
VVEJGA	-	GPHS-RTG	8.0×10^{-7}	$7.9\text{x } 10^{-1}$	6.3×10^{-7}	3.20×10^{4}
		LWRHU[(d)]	8.0×10^{-7}	1.0×10^{0}	8.0×10^{-7}	6.22×10^{2}
		Combined	8.0×10^{-7}	1.0×10^{0}	8.0×10^{-7}	2.58×10^{4}

a. Initiating accident probability associated with launch-vehicle or space-vehicle related failures.
b. Conditional probability associated with accident environment sequence and fuel release conditions.
c. Product of initiating accident probability and conditional probability.
d. The LWRHU analysis used an earlier estimate of the initiating probability of Phase 0 accidents.

Table D-1 Summary of Accident Source Terms (Page 2 of 2)

Mission Segment	Mission Phase	Source Term Contribution	Total Probability[a]	Source Term, Ci				
				Mean	Percentile Level			
					5-th	50-th	95-th	99-th
Pre-Launch	0	GPHS-RTG	5.2×10^{-5}	4.68×10^{1}	3.20×10^{-1}	5.29×10^{0}	2.59×10^{1}	2.83×10^{2}
		LWRHU	1.1×10^{-5}	9.57×10^{-1}	b	b	b	b
		Combined	5.2×10^{-5}	4.70×10^{1}	3.20×10^{-1}	5.29×10^{0}	2.59×10^{1}	2.83×10^{2}
Early Launch	1	GPHS-RTG	6.7×10^{-4}	1.76×10^{2}	3.47×10^{-1}	4.86×10^{0}	6.34×10^{2}	4.32×10^{3}
		LWRHU	1.8×10^{-4}	2.12×10^{-1}	1.63×10^{-1}	2.45×10^{-2}	1.60×10^{-1}	5.29×10^{0}
		Combined	6.7×10^{-4}	1.76×10^{2}	3.91×10^{-1}	4.87×10^{0}	6.34×10^{2}	4.32×10^{3}
Late Launch	3-8	GPHS-RTG	2.1×10^{-3}	2.61×10^{0}	2.31×10^{-1}	1.58×10^{0}	8.30×10^{0}	1.54×10^{1}
		LWRHU	3.9×10^{-9}	1.54×10^{-4}	c	c	c	c
		Combined	2.1×10^{-3}	2.61×10^{0}	2.31×10^{-1}	1.58×10^{0}	8.30×10^{0}	1.54×10^{1}
VVEJGA	-	GPHS-RTG	6.3×10^{-7}	3.20×10^{4}	6.16×10^{-1}	1.48×10^{4}	1.19×10^{5}	1.48×10^{5}
		LWRHU	8.0×10^{-7}	6.22×10^{2}	2.34×10^{2}	3.96×10^{2}	2.60×10^{3}	2.88×10^{3}
		Combined	8.0×10^{-7}	2.58×10^{4}	2.34×10^{2}	1.21×10^{4}	9.63×10^{4}	1.19×10^{5}

a. Product of initiating accident and conditional probabilities.

b. No statistics generated because only four source terms were identified.

c. No statistics generated because the source term is either zero or 1.54×10^{-4} Ci.

Table D-2 Summary of Mean Radiological Consequences

Mission Segment	Mission Phase	Consequence Contribution	Collective Dose, person-rem[a]		Health Effects[a]		Maximum Individual Dose, rem[b]	Land Area Contaminated, km^2
			w/o De Minimis	w De Minimis	w/o De Minimis	w De Minimis		
Pre-Launch	0	GPHS-RTG	1.3×10^{1}	9.6×10^{1}	6.6×10^{-2}	5.3×10^{-2}	1.3×10^{-2}	1.5×10^{0}
		LWRHU	3.8×10^{2}	-	1.9×10^{-1}	-	2.5×10^{-3}	-
		Combined	2.1×10^{2}	9.6×10^{1}	1.1×10^{-1}	5.3×10^{-2}	1.4×10^{-2}	1.5×10^{0}
Early Launch	1	GPHS-RTG	1.4×10^{2}	9.6×10^{1}	7.1×10^{-2}	4.8×10^{-2}	2.1×10^{-2}	1.6×10^{0}
		LWRHU	8.4×10^{1}	-	4.2×10^{-2}	-	5.6×10^{-4}	-
		Combined	1.6×10^{2}	9.6×10^{1}	8.2×10^{-2}	4.8×10^{-2}	2.1×10^{-2}	1.6×10^{0}
Late Launch	3-8	GPHS-RTG	8.8×10^{1}	7.9×10^{1}	4.4×10^{-2}	3.9×10^{-2}	1.1×10^{0}	5.7×10^{-2}
		LWRHU	4.8×10^{-3}	-	2.4×10^{-6}	-	7.7×10^{-6}	-
		Combined	8.8×10^{1}	7.9×10^{1}	4.4×10^{-2}	3.9×10^{-2}	1.1×10^{0}	5.7×10^{-2}
VVEJGA	-	GPHS-RTG	2.6×10^{5}	3.7×10^{4}	1.4×10^{2}	2.6×10^{1}	6.5×10^{2}	1.9×10^{1}
		LWRHU	2.6×10^{4}	5.0×10^{1}	1.3×10^{1}	2.5×10^{-2}	2.1×10^{-2}	1.7×10^{-1}
		Combined	2.3×10^{5}	2.9×10^{4}	1.2×10^{2}	2.0×10^{1}	5.1×10^{2}	1.5×10^{1}
Overall Mission	-	GPHS-RTG	1.6×10^{2}	9.2×10^{1}	8.2×10^{-2}	4.7×10^{-1}	9.7×10^{-1}	4.5×10^{-1}
		LWRHU	2.1×10^{2}	2.1×10^{-1}	1.0×10^{-1}	1.0×10^{-4}	7.6×10^{-4}	7.1×10^{-4}
		Combined	1.7×10^{2}	9.2×10^{1}	8.9×10^{-2}	4.7×10^{-1}	9.7×10^{-1}	4.5×10^{-1}

a. Collective dose and health effects reported with and without a de minimis dose level of 0.001 rem per year applied.

b. Maximally exposed individual dose.

Table D-3 Summary of 5-th Percentile Radiological Consequences

Mission Segment	Mission Phase	Consequence Contribution	Collective Dose, person-rem[a]		Health Effects[a]		Maximum Individual Dose, rem[b]	Land Area Contaminated, km^2
			w/o De Minimis	w De Minimis	w/o De Minimis	w De Minimis		
Pre-Launch	0	GPHS-RTG	6.6×10^{-2}	-	3.3×10^{-5}	-	2.5×10^{-5}	5.1×10^{-3}
		LWRHU	3.3×10^{1}	-	1.6×10^{-2}	-	1.0×10^{-5}	-
		Combined	7.0×10^{0}	-	3.4×10^{-3}	-	2.7×10^{-5}	5.1×10^{-3}
Early Launch	1	GPHS-RTG	8.4×10^{-2}	-	4.2×10^{-5}	-	4.3×10^{-5}	8.9×10^{-4}
		LWRHU	1.6×10^{0}	-	8.1×10^{-4}	-	1.0×10^{-5}	-
		Combined	5.1×10^{-1}	-	2.6×10^{-4}	-	4.6×10^{-5}	8.9×10^{-4}
Late Launch	3-8	GPHS-RTG	6.2×10^{-1}	4.9×10^{-1}	3.1×10^{-4}	2.4×10^{-4}	2.6×10^{-2}	-
		LWRHU	c	-	c	-	c	c
		Combined	6.2×10^{-1}	4.9×10^{-1}	3.1×10^{-4}	2.4×10^{-4}	2.6×10^{-2}	-
VVEJGA	-	GPHS-RTG	6.7×10^{3}	-	4.0×10^{0}	-	4.4×10^{-5}	-
		LWRHU	8.5×10^{3}	d	4.3×10^{0}	d	1.8×10^{-6}	1.3×10^{-1}
		Combined	1.4×10^{4}	-	7.4×10^{0}	-	3.6×10^{-5}	1.3×10^{-1}
Overall Mission	-	GPHS-RTG	2.0×10^{0}	3.9×10^{-1}	1.1×10^{-3}	1.8×10^{-4}	1.9×10^{-2}	3.1×10^{-4}
		LWRHU	3.9×10^{1}	-	2.0×10^{-2}	-	1.0×10^{-5}	5.4×10^{-4}
		Combined	4.6×10^{0}	3.9×10^{-1}	2.5×10^{-3}	1.8×10^{-4}	1.9×10^{-2}	3.5×10^{-4}

a. Collective dose and health effects reported with and without a de minimis dose level of 0.001 rem per year applied.
b. Maximally exposed individual dose.
c. No statistics generated due to low probability of release and small source term.
d. No statistics generated due to few cases above de minimis.

Table D-4 Summary of 50-th Percentile Radiological Consequences

Mission Segment	Mission Phase	Consequence Contribution	Collective Dose, person-rem[a]		Health Effects[a]		Maximum Individual Dose, rem[b]	Land Area Contaminated, km^2
			w/o De Minimis	w De Minimis	w/o De Minimis	w De Minimis		
Pre-Launch	0	GPHS-RTG	5.6×10^{0}	-	2.8×10^{-3}	-	5.0×10^{-4}	6.6×10^{-1}
		LWRHU	3.4×10^{2}	-	1.7×10^{-2}	-	1.2×10^{-4}	-
		Combined	7.8×10^{1}	-	6.4×10^{-3}	-	5.3×10^{-4}	6.6×10^{-1}
Early Launch	1	GPHS-RTG	1.2×10^{1}	5.3×10^{-4}	6.2×10^{-3}	2.6×10^{-7}	1.5×10^{-3}	5.0×10^{-1}
		LWRHU	1.2×10^{1}	-	5.8×10^{-3}	-	1.8×10^{-5}	-
		Combined	1.5×10^{1}	5.3×10^{-4}	7.8×10^{-3}	2.6×10^{-7}	1.5×10^{-3}	5.0×10^{-1}
Late Launch	3-8	GPHS-RTG	1.6×10^{1}	1.4×10^{1}	8.2×10^{-3}	7.3×10^{-3}	4.8×10^{-1}	3.0×10^{-2}
		LWRHU	c	-	c	-	c	-
		Combined	1.6×10^{1}	1.4×10^{1}	8.2×10^{-3}	7.3×10^{-3}	4.8×10^{-1}	3.0×10^{-2}
VVEJGA	-	GPHS-RTG	1.9×10^{5}	-	1.1×10^{2}	-	3.0×10^{-4}	-
		LWRHU	1.5×10^{4}	d	7.4×10^{0}	d	4.0×10^{-6}	1.7×10^{-1}
		Combined	1.6×10^{5}	-	9.4×10^{1}	-	2.4×10^{-4}	1.7×10^{-1}
Overall Mission	-	GPHS-RTG	5.7×10^{1}	1.0×10^{1}	3.2×10^{-2}	5.6×10^{-3}	3.6×10^{-1}	1.5×10^{-1}
		LWRHU	9.3×10^{1}	-	3.7×10^{-2}	-	2.4×10^{-5}	7.1×10^{-4}
		Combined	6.3×10^{1}	1.0×10^{1}	3.5×10^{-3}	5.6×10^{-3}	3.6×10^{-1}	1.5×10^{-1}

a. Collective dose and health effects reported with and without a de minimis dose level of 0.001 rem per year applied.
b. Maximally exposed individual dose.
c. No statistics generated due to low probability of release and small source term.
d. No statistics generated due to few cases above de minimis.

Table D-5 Summary of 95-th Percentile Radiological Consequences

Mission Segment	Mission Phase	Consequence Contribution	Collective Dose, person-rem[a]		Health Effects[a]		Maximum Individual Dose, rem[b]	Land Area Contaminated, km^2
			w/o De Minimis	w De Minimis	w/o De Minimis	w De Minimis		
Pre-Launch	0	GPHS-RTG	1.1×10^{2}	6.1×10^{0}	5.7×10^{-2}	3.0×10^{-3}	5.0×10^{-3}	5.5×10^{0}
		LWRHU	4.4×10^{2}	-	2.2×10^{-1}	-	5.8×10^{-3}	-
		Combined	2.0×10^{2}	6.1×10^{0}	1.0×10^{-1}	3.0×10^{-3}	6.2×10^{-3}	5.5×10^{0}
Early Launch	1	GPHS-RTG	3.4×10^{2}	1.2×10^{2}	1.7×10^{-1}	6.0×10^{-2}	5.7×10^{-2}	6.1×10^{0}
		LWRHU	8.8×10^{1}	-	4.4×10^{-2}	-	8.3×10^{-4}	-
		Combined	3.6×10^{2}	1.2×10^{2}	1.8×10^{-1}	6.0×10^{-2}	5.7×10^{-2}	6.1×10^{0}
Late Launch	3-8	GPHS-RTG	4.6×10^{2}	3.9×10^{2}	2.3×10^{-1}	2.0×10^{-1}	4.1×10^{0}	2.4×10^{-1}
		LWRHU	c	-	c	-	c	c
		Combined	4.6×10^{2}	3.9×10^{2}	2.3×10^{-1}	2.0×10^{-1}	4.1×10^{0}	2.4×10^{-1}
VVEJGA	-	GPHS-RTG	6.6×10^{5}	1.8×10^{5}	3.6×10^{2}	1.3×10^{2}	3.3×10^{3}	4.6×10^{1}
		LWRHU	7.9×10^{4}	d	3.9×10^{1}	d	6.3×10^{-5}	2.9×10^{-1}
		Combined	6.0×10^{5}	1.8×10^{5}	3.2×10^{2}	1.3×10^{2}	2.5×10^{3}	3.7×10^{1}
Overall Mission	-	GPHS-RTG	5.7×10^{2}	3.6×10^{2}	2.9×10^{-1}	1.9×10^{-1}	3.8×10^{0}	1.7×10^{0}
		LWRHU	4.4×10^{2}	-	2.2×10^{-1}	-	1.1×10^{-3}	1.2×10^{-3}
		Combined	6.0×10^{2}	3.6×10^{2}	3.0×10^{-1}	1.9×10^{-1}	3.8×10^{0}	1.7×10^{0}

a. Collective dose and health effects reported with and without a de minimis dose level of 0.001 rem per year applied.
b. Maximally exposed individual dose.
c. No statistics generated due to low probability of release and small source term.
d. No statistics generated due to few cases above de minimis.

Table D-6 Summary of 99-th Percentile Radiological Consequences

Mission Segment	Mission Phase	Consequence Contribution	Collective Dose, person-rem[a]		Health Effects[a]		Maximum Individual Dose, rem[b]	Land Area Contaminated, km^2
			w/o De Minimis	w De Minimis	w/o De Minimis	w De Minimis		
Pre-Launch	0	GPHS-RTG	3.6×10^{2}	4.1×10^{1}	1.8×10^{-1}	2.1×10^{-2}	1.6×10^{-2}	8.6×10^{0}
		LWRHU	8.2×10^{3}	-	4.1×10^{0}	-	2.7×10^{-2}	-
		Combined	2.1×10^{3}	4.1×10^{1}	1.0×10^{0}	2.1×10^{-2}	2.2×10^{-2}	8.6×10^{0}
Early Launch	1	GPHS-RTG	2.3×10^{3}	1.7×10^{3}	1.2×10^{0}	8.3×10^{-1}	3.1×10^{-1}	2.0×10^{1}
		LWRHU	2.5×10^{3}	-	1.3×10^{0}	-	9.7×10^{-2}	-
		Combined	3.0×10^{3}	1.7×10^{3}	1.5×10^{0}	8.3×10^{-1}	3.4×10^{-1}	2.0×10^{1}
Late Launch	3-8	GPHS-RTG	1.1×10^{3}	9.6×10^{2}	5.5×10^{-1}	9.3×10^{-1}	7.1×10^{0}	3.4×10^{-1}
		LWRHU	c	-	c	-	c	c
		Combined	1.1×10^{3}	9.6×10^{2}	5.5×10^{-1}	9.3×10^{-1}	7.1×10^{0}	3.4×10^{-1}
VVEJGA	-	GPHS-RTG	8.9×10^{5}	3.9×10^{5}	4.8×10^{2}	2.7×10^{2}	4.9×10^{3}	7.0×10^{1}
		LWRHU	1.4×10^{5}	d	7.0×10^{1}	d	2.0×10^{-1}	2.9×10^{-1}
		Combined	8.4×10^{5}	3.9×10^{5}	4.5×10^{2}	2.7×10^{2}	3.9×10^{3}	5.5×10^{1}
Overall Mission	-	GPHS-RTG	1.6×10^{3}	1.2×10^{3}	8.0×10^{-1}	9.5×10^{-1}	6.4×10^{0}	5.2×10^{0}
		LWRHU	3.4×10^{3}	-	1.7×10^{0}	-	9.3×10^{-2}	1.2×10^{-3}
		Combined	1.8×10^{3}	1.2×10^{3}	9.2×10^{-1}	9.5×10^{-1}	6.4×10^{0}	5.2×10^{0}

a. Collective dose and health effects reported with and without a de minimis dose level of 0.001 rem per year applied.
b. Maximally exposed individual dose.
c. No statistics generated due to low probability of release and small source term.
d. No statistics generated due to few cases above de minimis.

Table D-7 Summary of Mission Risks

Mission Segment	Mission Phase	Mission Risk Contribution	Total Probability[a]	Health Effects [b]		Mission Risks [c]	
				w/o De Minimis	w De Minimis	w/o De Minimis	w De Minimis
Pre-Launch	0	GPHS-RTG	5.2×10^{-5}	6.6×10^{-2}	5.3×10^{-2}	3.4×10^{-6}	2.8×10^{-6}
		LWRHU	1.1×10^{-5}	1.9×10^{-1}	-	2.1×10^{-6}	-
		Combined	5.2×10^{-5}	1.1×10^{-1}	5.3×10^{-2}	5.5×10^{-6}	2.8×10^{-6}
Early Launch	1	GPHS-RTG	6.7×10^{-4}	7.0×10^{-2}	4.8×10^{-2}	4.7×10^{-5}	3.2×10^{-5}
		LWRHU	1.8×10^{-4}	4.2×10^{-2}	-	7.6×10^{-6}	-
		Combined	6.7×10^{-4}	8.1×10^{-2}	4.8×10^{-2}	5.5×10^{-5}	3.2×10^{-5}
Late Launch	3-8	GPHS-RTG	2.1×10^{-3}	4.4×10^{-2}	3.9×10^{-2}	9.2×10^{-5}	8.2×10^{-5}
		LWRHU	3.9×10^{-9}	2.4×10^{-6}	-	8.9×10^{-15}	-
		Combined	2.1×10^{-3}	4.4×10^{-2}	3.9×10^{-2}	9.2×10^{-5}	8.2×10^{-5}
VVEJGA	-	GPHS-RTG	6.3×10^{-7}	1.4×10^{2}	2.6×10^{1}	8.8×10^{-5}	1.6×10^{-5}
		LWRHU	8.0×10^{-7}	1.3×10^{1}	2.5×10^{-2}	1.0×10^{-5}	2.0×10^{-8}
		Combined	8.0×10^{-7}	1.2×10^{2}	2.0×10^{1}	9.8×10^{-5}	1.6×10^{-5}
Overall Mission	-	GPHS-RTG	2.8×10^{-3}	8.2×10^{-2}	4.7×10^{-2}	2.3×10^{-4}	1.3×10^{-4}
		LWRHU	1.9×10^{-4}	1.0×10^{-1}	1.1×10^{-4}	2.0×10^{-5}	2.0×10^{-8}
		Combined	2.8×10^{-3}	8.9×10^{-2}	4.7×10^{-2}	2.5×10^{-4}	1.3×10^{-4}

a. Total source term probability.
b. Health effects reported as excess cancer fatalities with and without a de minimis dose level of 0.001 rem per year applied.
c. Risk calculated as the total probability times health effects.

Table D-8 Summary of Average Individual Risks

Mission Segment	Mission Phase	Mission Risk Contribution	Average Individual Risks[a]	
			w/o De Minimis	w De Minimis
Pre-Launch	0	GPHS-RTG	3.4×10^{-11}	2.8×10^{-11}
		LWRHU	2.1×10^{-11}	-
		Combined	5.5×10^{-11}	2.8×10^{-11}
Early Launch	1	GPHS-RTG	4.7×10^{-10}	3.2×10^{-10}
		LWRHU	7.6×10^{-11}	-
		Combined	5.5×10^{-10}	3.2×10^{-10}
Late Launch	3-8	GPHS-RTG	1.8×10^{-8}	1.6×10^{-8}
		LWRHU	1.6×10^{-18}	-
		Combined	1.8×10^{-8}	1.6×10^{-8}
VVEJGA	-	GPHS-RTG	4.6×10^{-14}	2.6×10^{-14}
		LWRHU	4.0×10^{-15}	4.0×10^{-18}
		Combined	5.0×10^{-14}	2.6×10^{-14}

a. Average individual risk equals mission risk contribution from Table D-7 divided by an order of magnitude estimate of the population receiving most of the collective dose, (Pre-Launch, Early-launch = 10^5 persons; Late Launch = $5x10^3$ persons; VVEJGA = $5X10^9$ persons).

Table D-9 Summary of GPHS-RTG Uncertainty Analysis Results

Mission Segment	Mean Risk	5% Confidence Level	50% Confidence Level	95% Confidence Level
Pre-Launch	3.4×10^{-6}	7.6×10^{-8}	6.0×10^{-6}	4.2×10^{-4}
Early Launch	4.7×10^{-5}	5.1×10^{-6}	6.2×10^{-5}	7.9×10^{-4}
Late Launch	9.2×10^{-5}	4.1×10^{-7}	7.3×10^{-5}	1.3×10^{-2}
VVEJGA	8.8×10^{-5}	1.2×10^{-6}	7.5×10^{-5}	4.6×10^{-3}
Overall	2.3×10^{-4}	8.3×10^{-6}	2.2×10^{-4}	1.9×10^{-2}

Table D-10 Summary of Information Source and Notes (Page 1 of 3)

1.	**Table D-1**	**Summary of Accident Source Terms**	
	GPHS-RTG	a.	Pre-Launch, Early Launch (accident scenarios 1.1, 1.3, 1.10 and 1.13), Late Launch, and VEEJGA: LMM&S 1997j, Table 4, p. 19. Early launch (accident scenarios 1.2, 1.4, 1.5, 1.6, 1.7, 1.8, and 1.9): LMM&S 1997g, Table D.3-1, p. D-16. The referenced RTG FSAR tables reported source terms in grams, which were converted to curies (Ci) in Table D-1 using a specific activity of 12.31 Ci/g. The probability of release (POR) for Early Launch accident scenario 1.10 was changed from 2.1×10^{-7} to $2.1\ 10^{-5}$ to be consistent with all other relevant information in LMM&S 1997h.
		b.	Results for Early and Late Launch were probability weighted using the total probability of release (POR) for each accident scenario form LMM&S 1997h, Table 4.2-3, p. 4-13. In the latter table, the POR for accident scenario 1.1 was changed from 4.4×10^{-4} to 4.5×10^{-4} (to be consistent with all other related information in LMM&S 1997h), resulting in a change in the POR for Early Launch from 6.6×10^{-4} to 6.7×10^{-4}.
	LWRHU	c.	EG&G 1997, Table VII-3, p. VII-4. The referenced LWRHU FSAR table reported source terms in becquerel (Bq), which were converted to Ci in Table D-1 by dividing the Bq by 3.7×10^{10} Bq/Ci.
		d.	Results for Early and Late Launch were probability weighted using the POR for each accident scenario from EGG&G, Table 9-3, p. 9-5.
2.	**Table D-2**	**Summary of Mean Radiological Consequences**	
	GPHS-RTG	a.	LMM&S 1997h, Table 3.3-4, p. 3-15
		b.	Note 1.b applies.
	LWRHU	c.	EGG&G 1997h: Collective dose (w de minimis): Table VII-9, p. VII-11 Health effect (w/o de mininis): Table VII-10, p. VII-12 Maximum individual dose: Table VII-11, p. VII-13 Land contamination: Table VII-12, p. VII-14
		d.	Note 1.d applies.

Table D-10 Summary of Information Source and Notes (Page 2 of 3)

3.	**Table D-3**	**Summary of 5-th Percentile Radiological Consequences**	
	GPHS-RTG	a.	LMM&S 1997h, Table 3.3-5, p. 3-16.
		b.	Note 1.b above applies.
	LWRHU	c.	Note 1.d and 2.c above apply.
4.	**Table D-4**	**Summary of 50-th Percentile Radiological Consequences**	
	GPHS-RTG	a.	LMM&S 1997h, Table 3.3-6, p. 3-17.
		b.	Note 1.b above applies.
	LWRHU	c.	Note 1.d and 2.c above apply.
5.	**Table D-5**	**Summary of 95-th Percentile Radiological Consequences**	
	GPHS-RTG	a.	LMM&S 1997h, Table 3.3-7, p. 3-18.
		b.	Note 1.b above applies.
	LWRHU	c.	Note 1.d and 2.c above apply.
5.	**Table D-5**	**Summary of 99-th Percentile Radiological Consequences**	
	GPHS-RTG	a.	LMM&S 1997h, Table 3.3-8, p. 3-19.
		b.	Note 1.b above applies.
	LWRHU	c.	Note 1.d and 2.c above apply.

Table D-10 Summary of Information Source and Notes (Page 3 of 3)

7.	**Table D-7**	**Summary of Mission Risks**
	a.	Total probabilities: Table D-1 of this appendix
	b.	Health effects (w and w/o de minimis): Table D-2 of this appendix
GPHS-RTG	c.	The mission risk values (w/o de minimis) for Late Launch (9.2×10^{-5}) and VVEJGA (8.8×10^{-5}) are calculated in Table D-7 as the porduct of the total probability times mean health effects. LMM&S 1997 h and j report these values as 9.4×10^{-5} and 8.6×10^{-5} for the same total probabilities and mean health effects as presented in Table D-7.
8.	**Table D-8**	**Summary of Average Individual Risks**
	a.	Mission risks from Table D-7 of this appendix
	b.	Note 7.c above applies.
9.	**Table D-9**	**Summary of Uncertainty analysis Results for GPHS-RTG**
	a.	Note 7.c above applies.
	b.	5%confidence level: LMM&S 1997h, Table 2.5-4, p. 2-35 50%confidence level: LMM&S 1997h, Table 2.5-5, p. 2-36 95%confidence level: LMM&S 1997h, Table 2.5-6, p. 2-37

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